Wing Mean Aerodynamic Chord, Area, Aspect Ratio and CG Position

Area, aspect ratio, taper, mean aerodynamic chord and its spanwise and fore-and-aft position for a straight-tapered wing, with the 25 % MAC balance point.

Method: Geometry of a straight-tapered wing

Input parameters

Unit system: SI

Parameter	Value	Unit
Root chord	300.00	mm
Tip chord	180.00	mm
Wing span (tip to tip)	1,600.0	mm
Leading-edge sweep	5.0000	°
Balance point as a fraction of MAC (typically 0.25–0.30)	25.000	%

Calculated results

Parameter	Value	Unit
Wing area	0.38400	m²
Aspect ratio b²/S	6.6667	
Taper ratio c_t/c_r	0.60000	
Mean aerodynamic chord	245.00	mm
Spanwise position of the MAC from the centreline	366.67	mm
Leading edge of the MAC aft of the root leading edge	32.079	mm
Balance point aft of the root leading edge	93.329	mm

Notes for this case

- Straight-tapered (trapezoidal) wing panels. The aerodynamic centre lies near 25 % of the MAC at subsonic speed; a balance point at 25–30 % MAC is a common first estimate for a conventional aircraft with a tail.

Formula and method

$$\bar{c} = \frac{2}{3} c_r \frac{1+\lambda+\lambda^2}{1+\lambda}, \quad \bar{y} = \frac{b}{6}\frac{1+2\lambda}{1+\lambda}, \quad x_{LE,\bar{c}} = \bar{y}\tan\Lambda_{LE}, \quad S = \frac{b(c_r+c_t)}{2}$$

Variables

c_r	Root chord	m
c_t	Tip chord	m
b	Wing span (tip to tip)	m
Λ_{LE}	Leading-edge sweep	rad
h	Balance point as a fraction of MAC (typically 0.25–0.30)	-
S	Wing area	m²
AR	Aspect ratio b²/S	-
λ	Taper ratio c_t/c_r	-
$\bar{c}$	Mean aerodynamic chord	m
$\bar{y}$	Spanwise position of the MAC from the centreline	m
$x_{LE,\bar{c}}$	Leading edge of the MAC aft of the root leading edge	m

x_{CG}	Balance point aft of the root leading edge	m

Method and standards

Trapezoidal wing geometry.

Assumptions and limits

- Straight-tapered panels; no dihedral effect on the plan form.

References

Geometry of a straight-tapered wing

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

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